Acute Rhythm Recognition, Electrotherapy and Stable Treatment

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Legal Stuff

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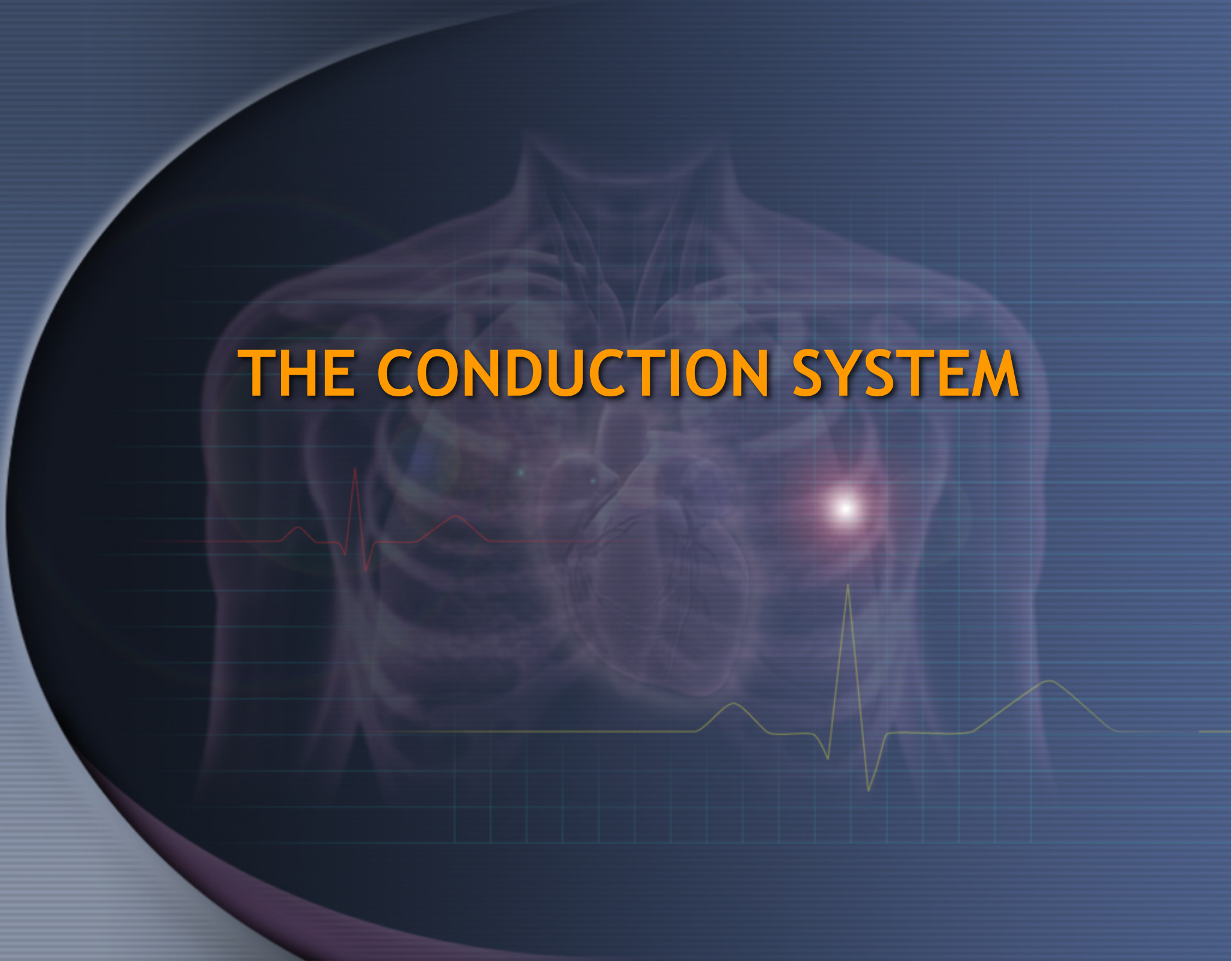
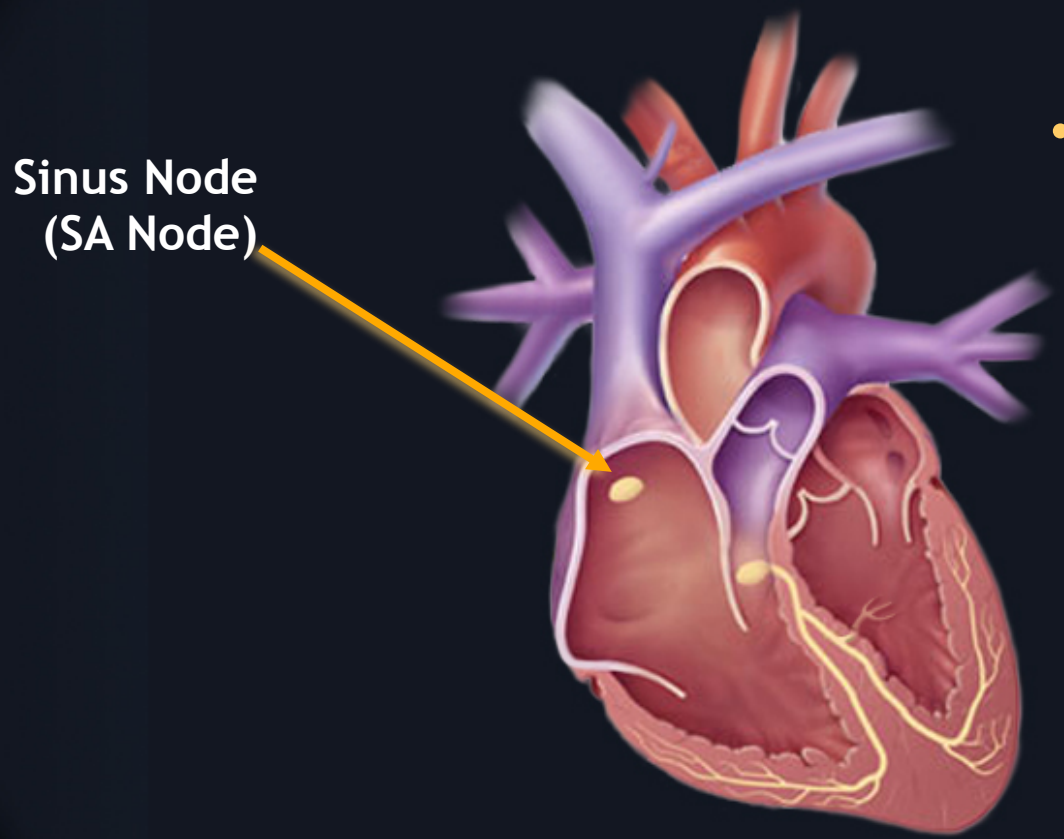
Objectives

- Identify the components that make up the electrical pathway known as the conduction system
- State the 5 phases of action potential
- Describe the mechanisms causing rhythm disorders
- Identify rhythm disorders on an EKG

THE CONDUCTION SYSTEM



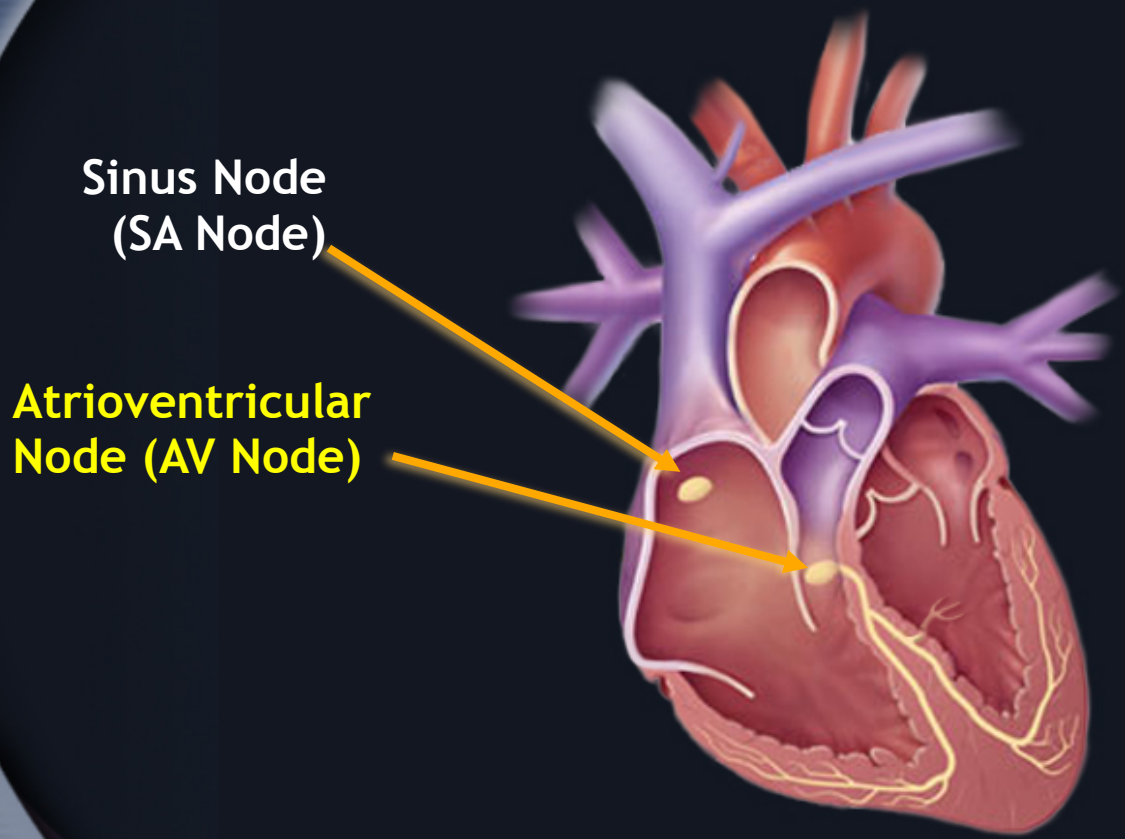
Heart Beat Anatomy



SINUS NODE

- The Heart's 'Natural Pacemaker'
  - 60-100 BPM at rest

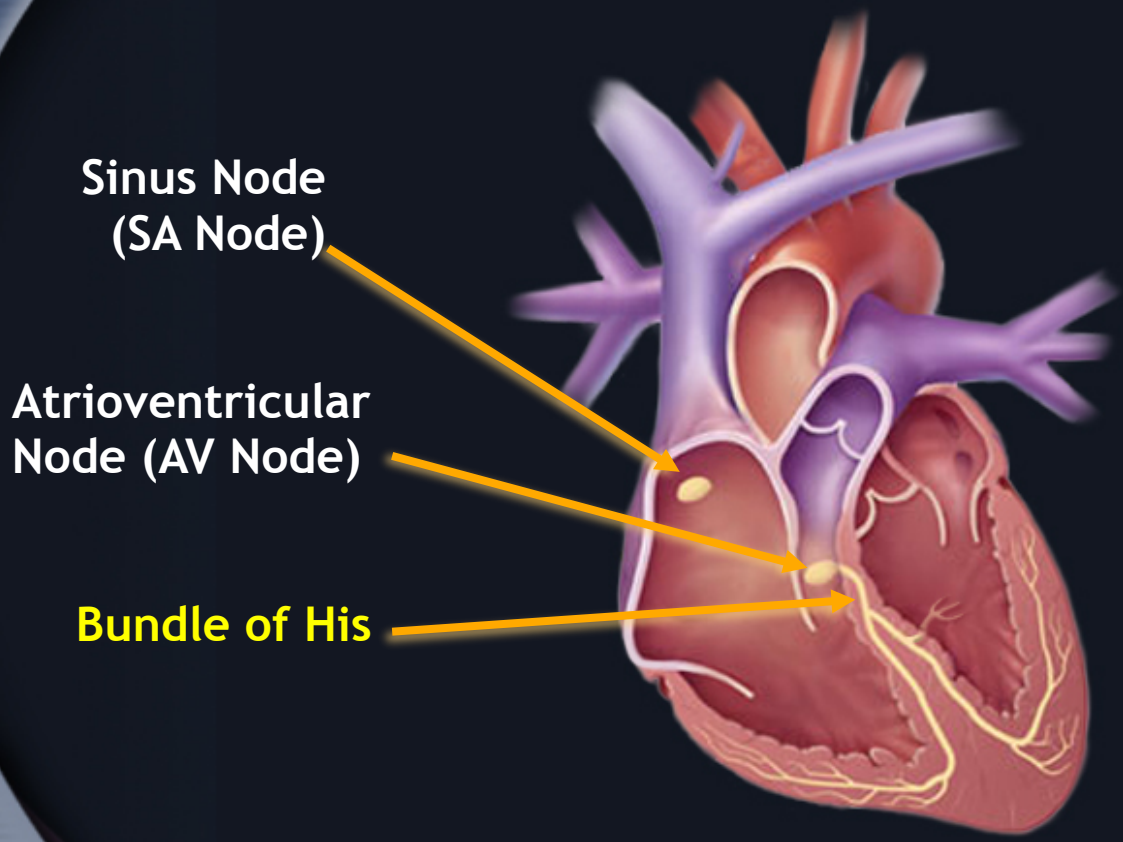
Heart Beat Anatomy



AV NODE

- Receives impulse from SA Node
- Delivers impulse to the His-Purkinje System
- 40-60 BPM if SA Node fails to deliver an impulse

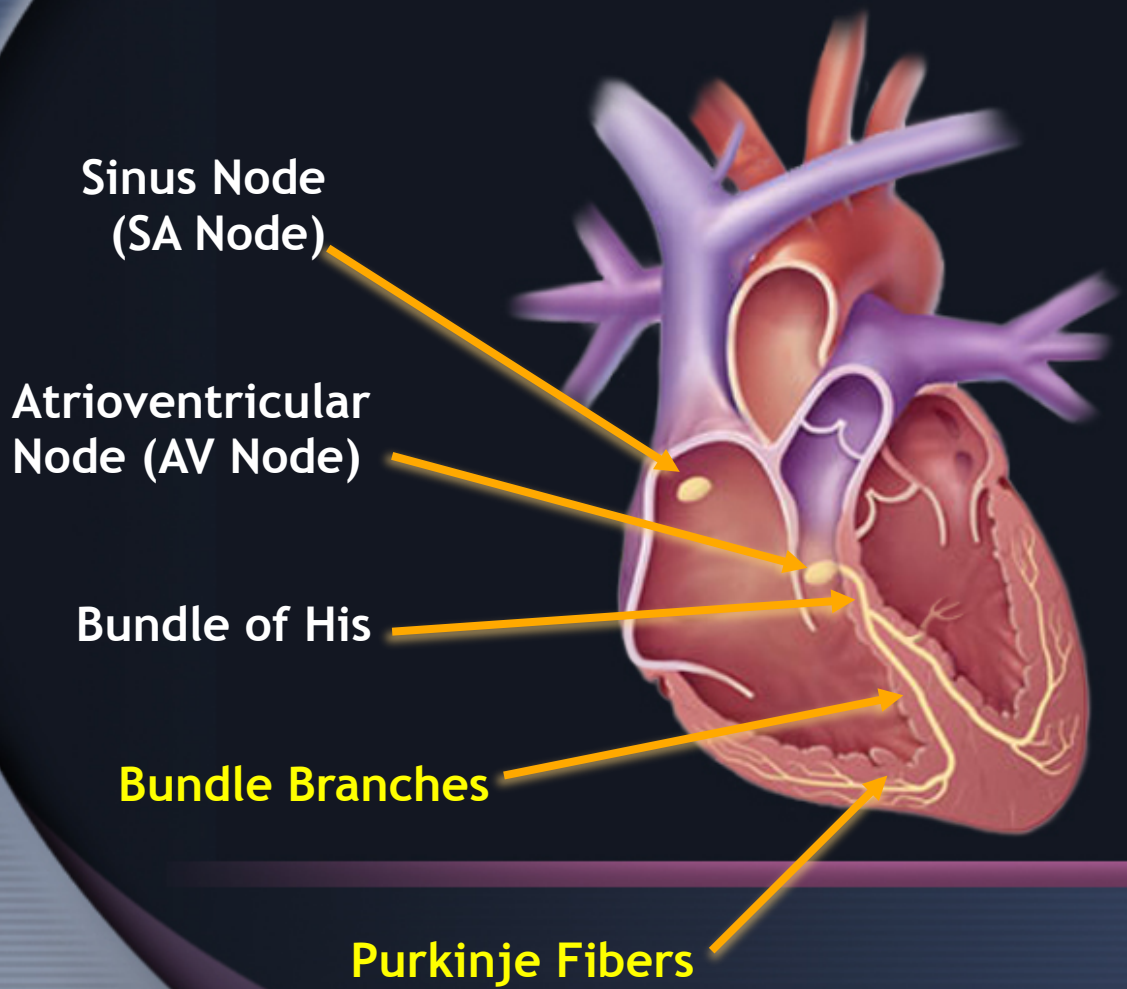
Heart Beat Anatomy



BUNDLE OF HIS

- Begins conduction to the Ventricles
- AV Junctional Tissue: 40-60 BPM

Heart Beat Anatomy

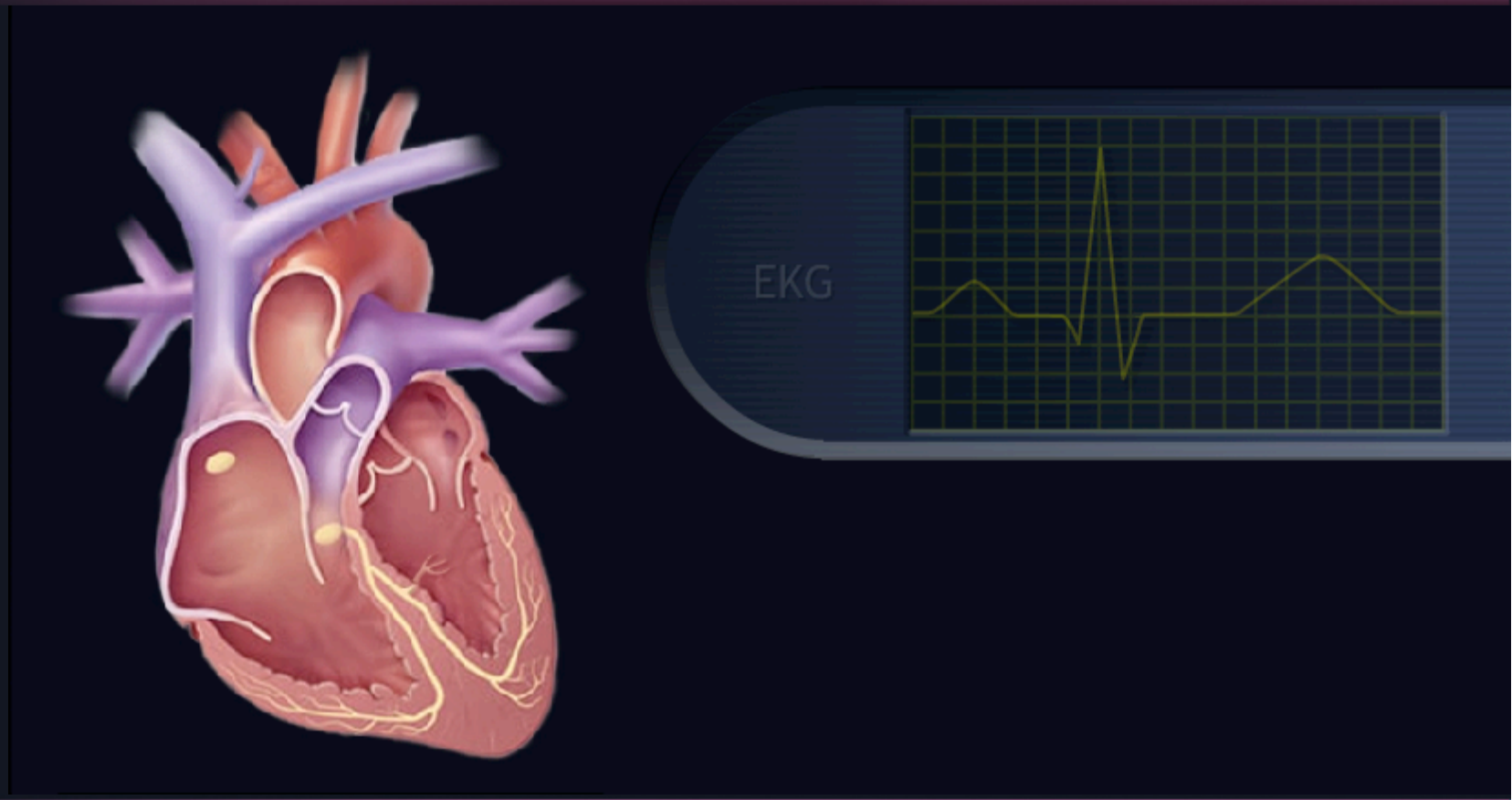


THE PURKINJE NETWORK

- Bundle Branches
- Purkinje Fibers
- Moves the impulse through the ventricles for contraction
- Provides 'Escape Rhythm': 20-40 BPM

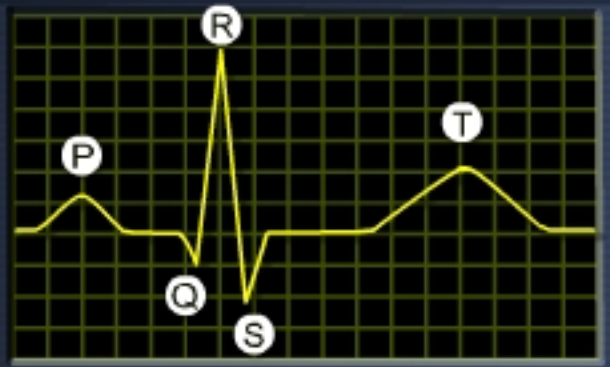
Normal Sinus Rhythm

* *Animation*

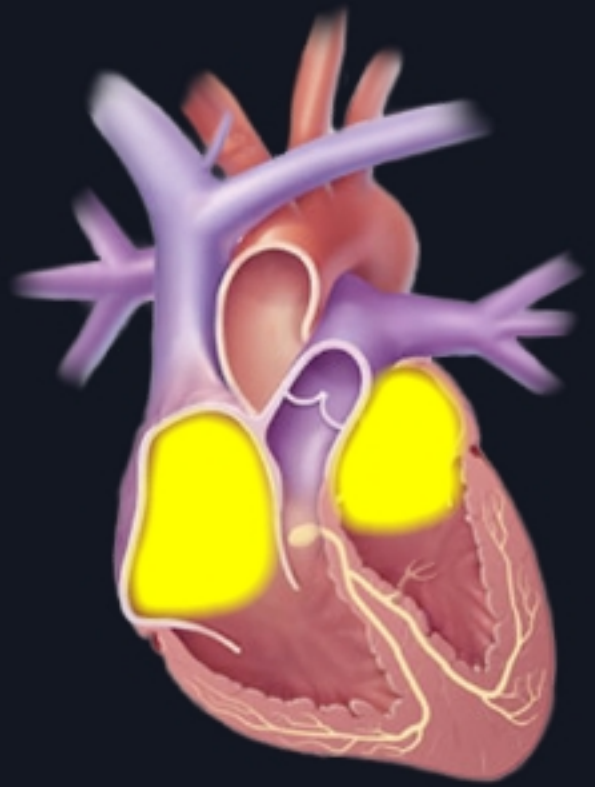


Impulse Formation In SA Node

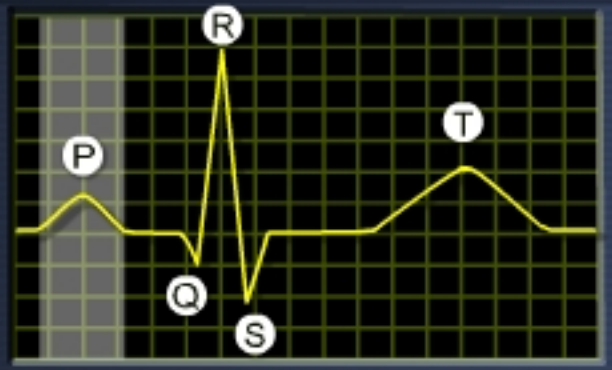
EKG



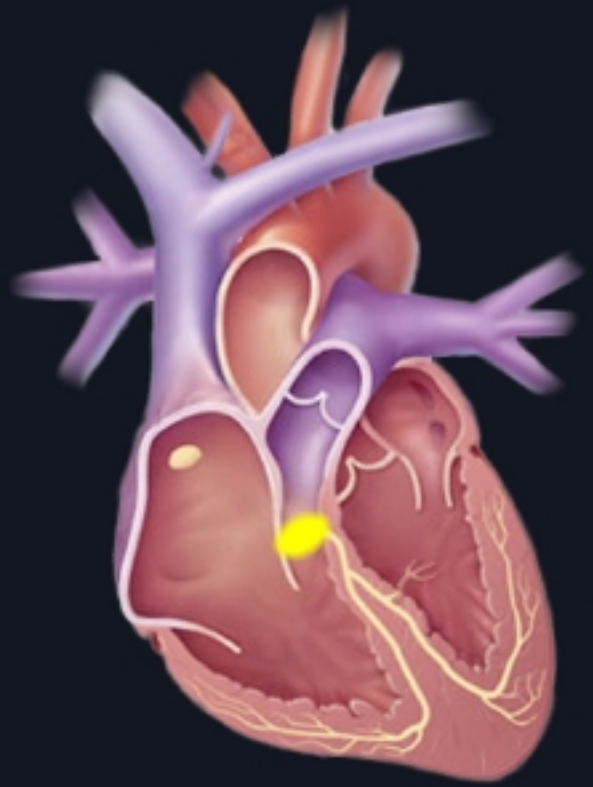
Atrial Depolarization



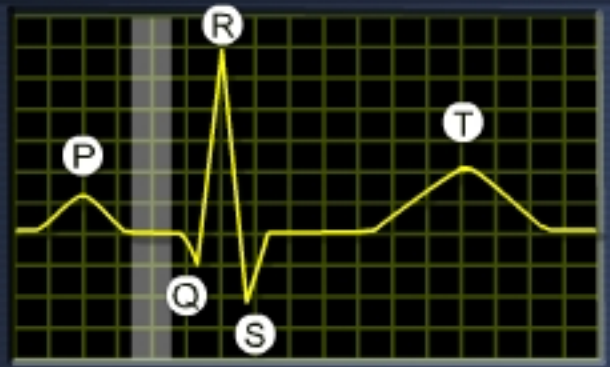
EKG



Delay At AV Node

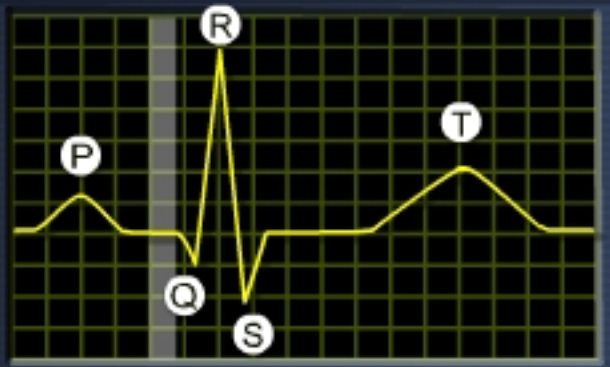


EKG



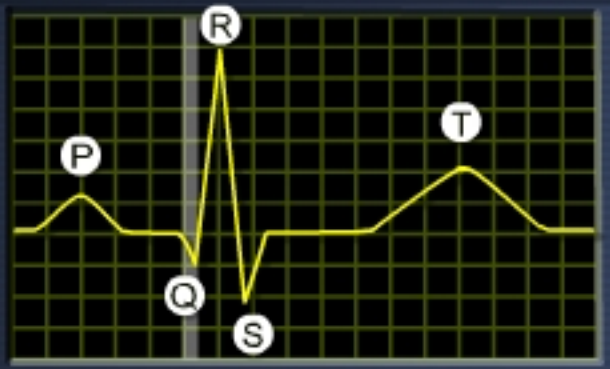
Conduction Through Bundle Branches

EKG

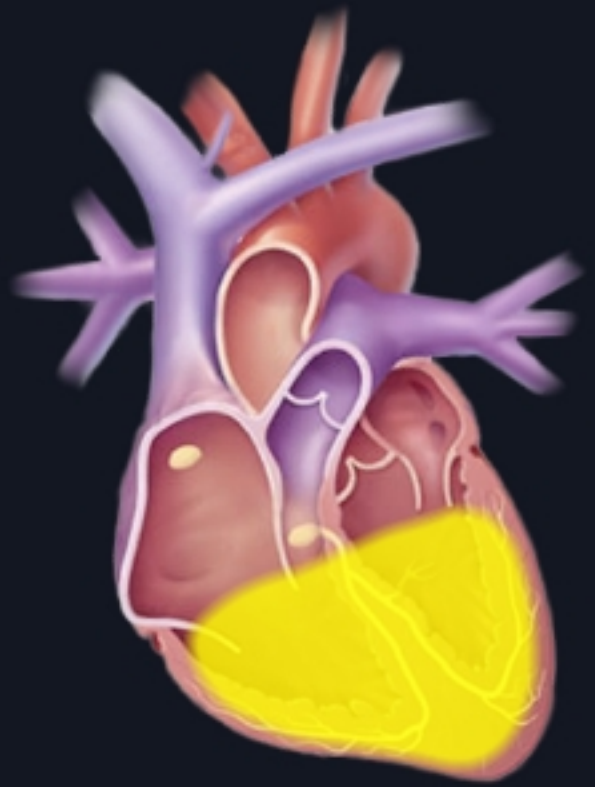


Conduction Through Purkinje Fibers

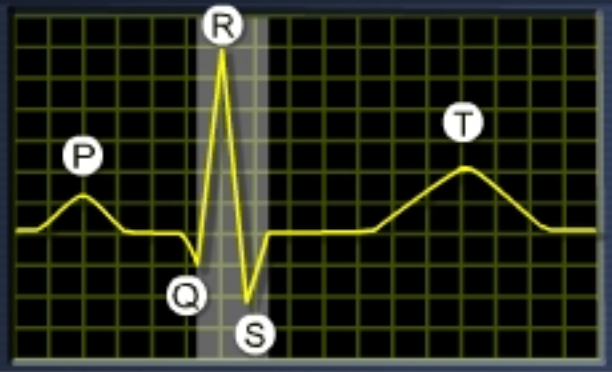
EKG



Ventricular Depolarization

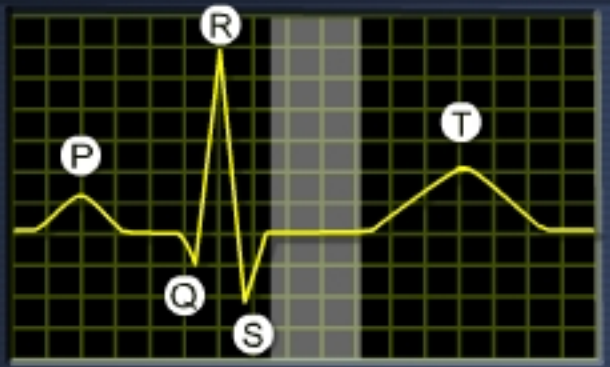


EKG



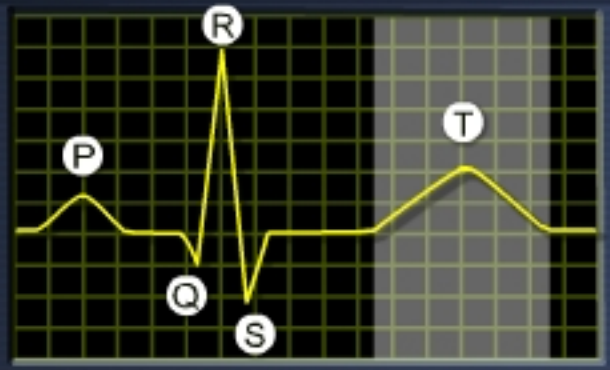
Plateau Phase of Repolarization

EKG

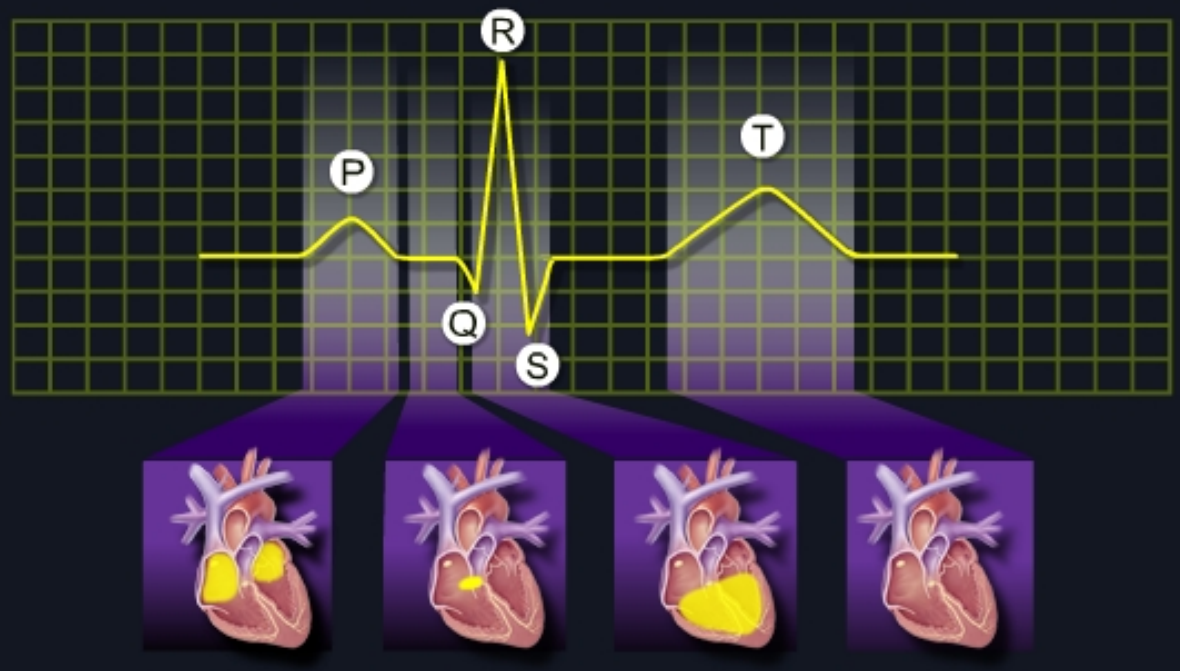


Final Rapid (Phase 3) Repolarization

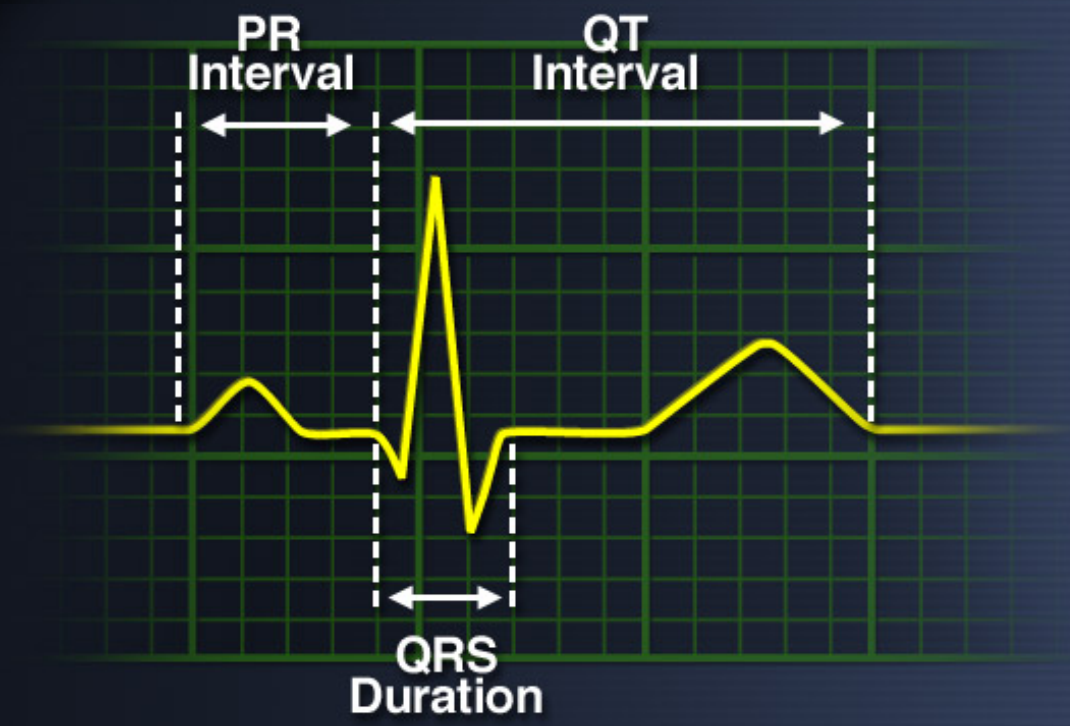
EKG



Normal EKG Activation



Reading EKGs

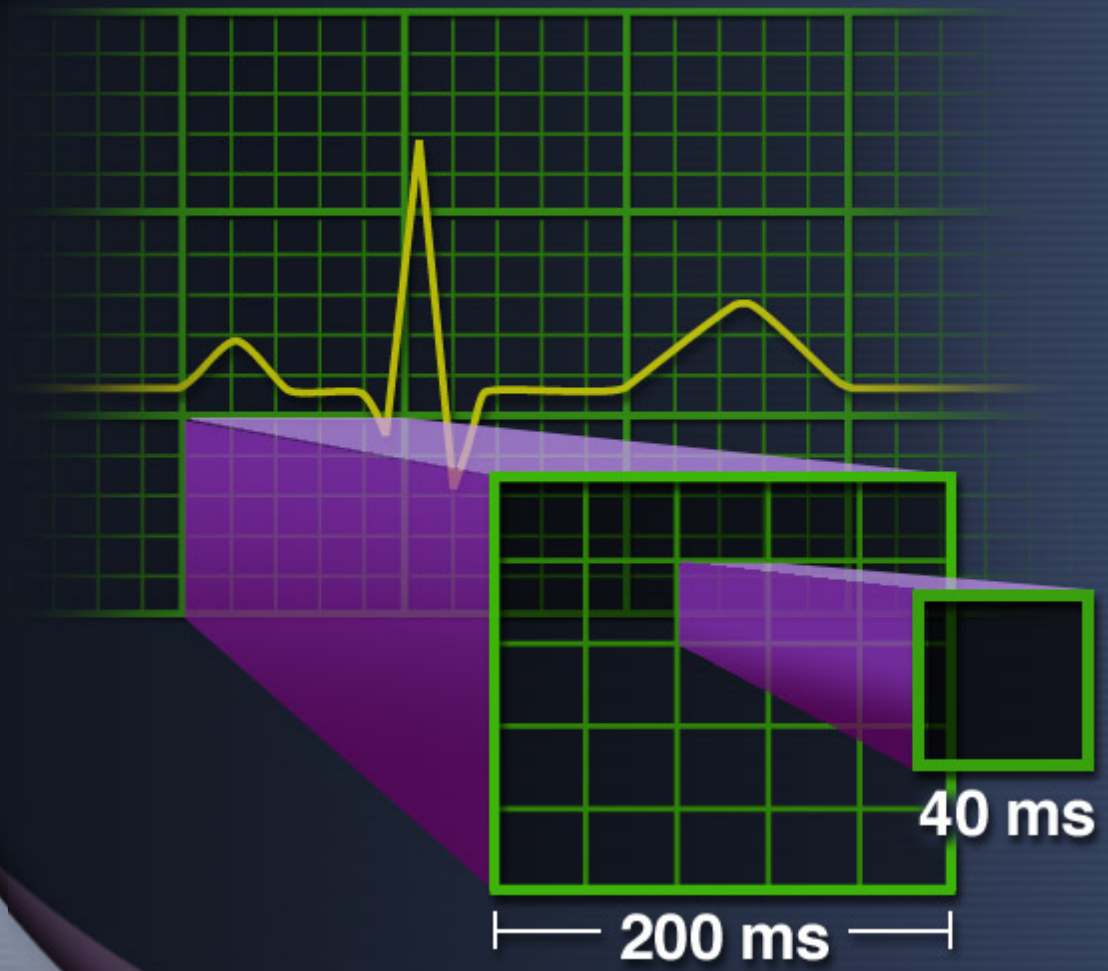


Intervals and Timing

Normal Ranges in Milliseconds:

- PR Interval .12 -.20 sec
- QRS Complex < .12 sec
- QT Interval .36 - .44 sec

Reading EKG Squares



Intervals and Timing

Each square = .04 sec

Each interval = .20 sec

The Five-Step Approach

- This five-step approach, in order of application, includes analysis of the following
  - **Step 1: Heart rate**
  - **Step 2: Heart rhythm**
  - **Step 3: P wave**
  - **Step 4: PR interval**
  - **Step 5: QRS complex**

Determining Rate

- **6 Second Method**
  - Count the number of QRS complexes in a six second strip and multiply x 10
- **R to R Method**
  - The number of large boxes between two R waves and divide into 300
  - The number of small boxes between two R Waves and divide into 1500

Question?

How do we measure heart rate?

BPM

(Beats Per Minute)

Heart Rate

- SA node discharges impulses at a rate of **60-100** times per minute
- **Bradycardia**
  - Heart rate less than 60 bpm
- **Tachycardia**
  - Heart rate greater than 100

Regular Rhythm

- Measure the intervals between P to P waves or R to R waves

The P Wave

- P wave is produced when the right and left atria depolarize
- **First deviation from the isoelectric line**
- **Should be rounded and upright**
- P wave is SA node pacing or firing at regular intervals
- This pattern is referred to as a **sinus** rhythm

P Wave: Five Questions to Ask

Step 1: Are P waves present?

Step 2: Are P waves occurring regularly?

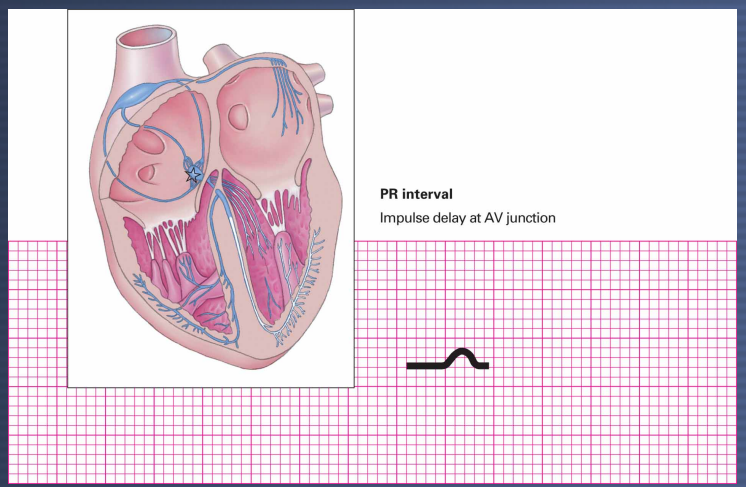
Step 3: Is there one P wave present for each QRS complex present?

Step 4: Are the P waves smooth, rounded,and upright in appearance, or are they inverted?

Step 5: Do all P waves look similar

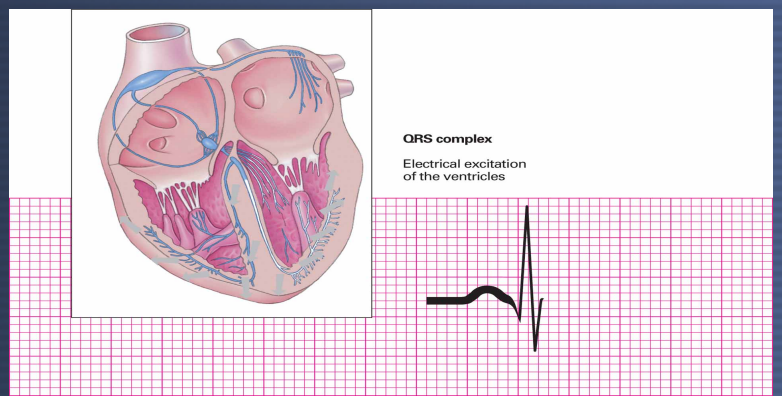
The PR Interval

- Measures the time interval from the onset of atrial contraction to onset of ventricular contraction
- **Measured from onset of P wave to the onset of the QRS complex**
- Normal interval is 0.12-0.20 seconds (3-5 small squares)



The QRS Complex

- Represents depolarization or contraction of the ventricles
  - **Q wave**
    - First negative or downward deflection of this large complex
  - **R wave**
    - First upward or positive deflection following the P wave (tallest waveform)
  - **S wave**
    - The sharp, negative, or downward deflection that follows the R wave



QRS Complex: 3 Questions to Ask

1. Are QRS intervals greater than 0.12 seconds (wide)?
2. Are QRS intervals less than 0.12 seconds (narrow)?
3. Are the QRS complexes similar in appearance across the EKG strip?

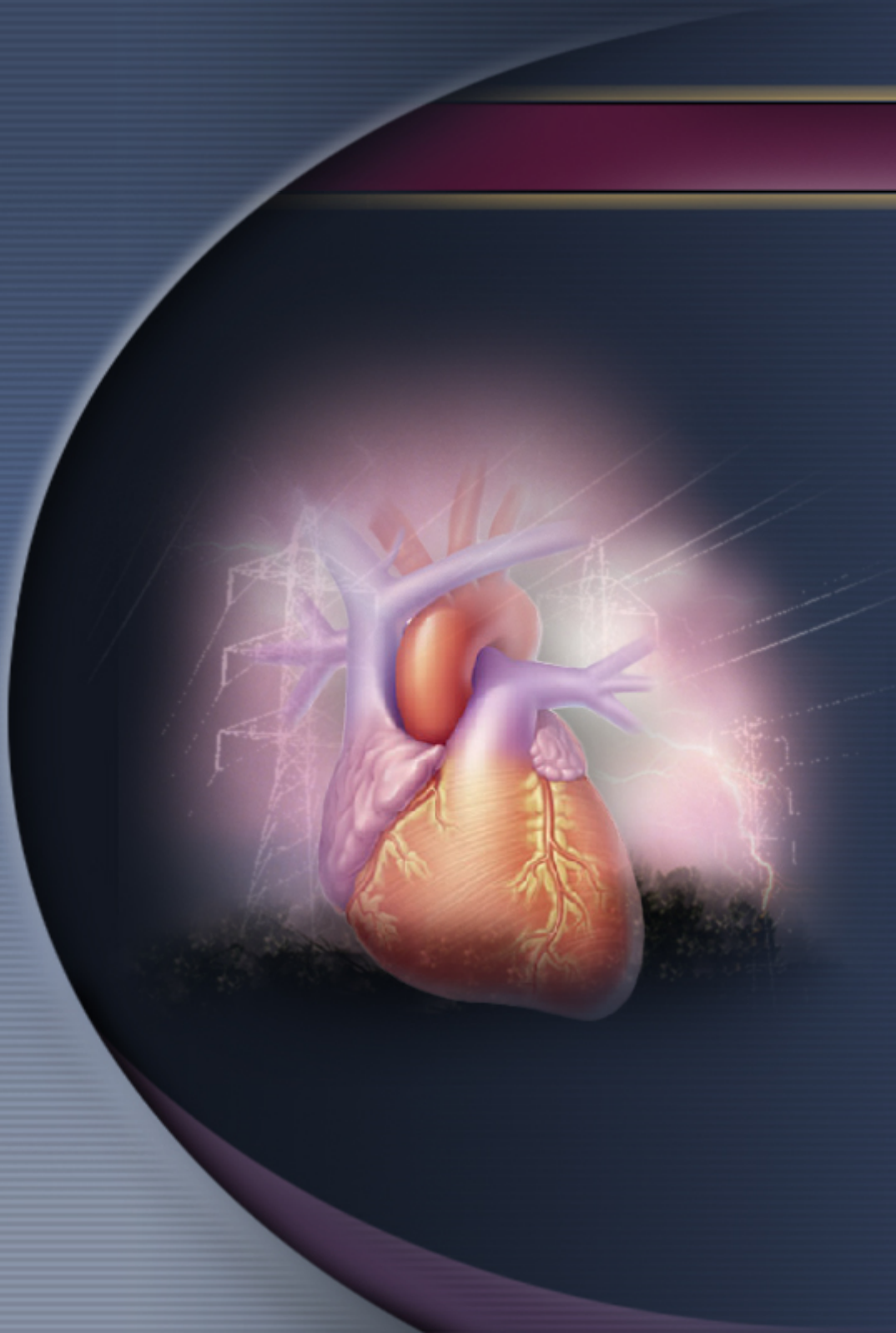
PR Interval: 3 Questions to Ask

1. Are PR intervals greater than 0.20 seconds?
2. **Are PR intervals less than 0.12 seconds?**
3. Are the PR intervals constant across the EKG strip?

Question?

Where does the SA Node get its energy?

Automaticity

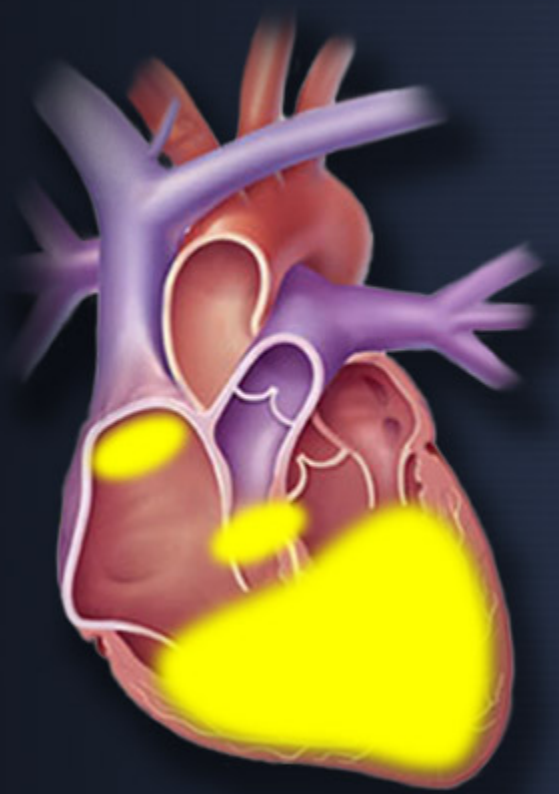


Cardiac Cells have

AUTOMATICITY!

Automaticity

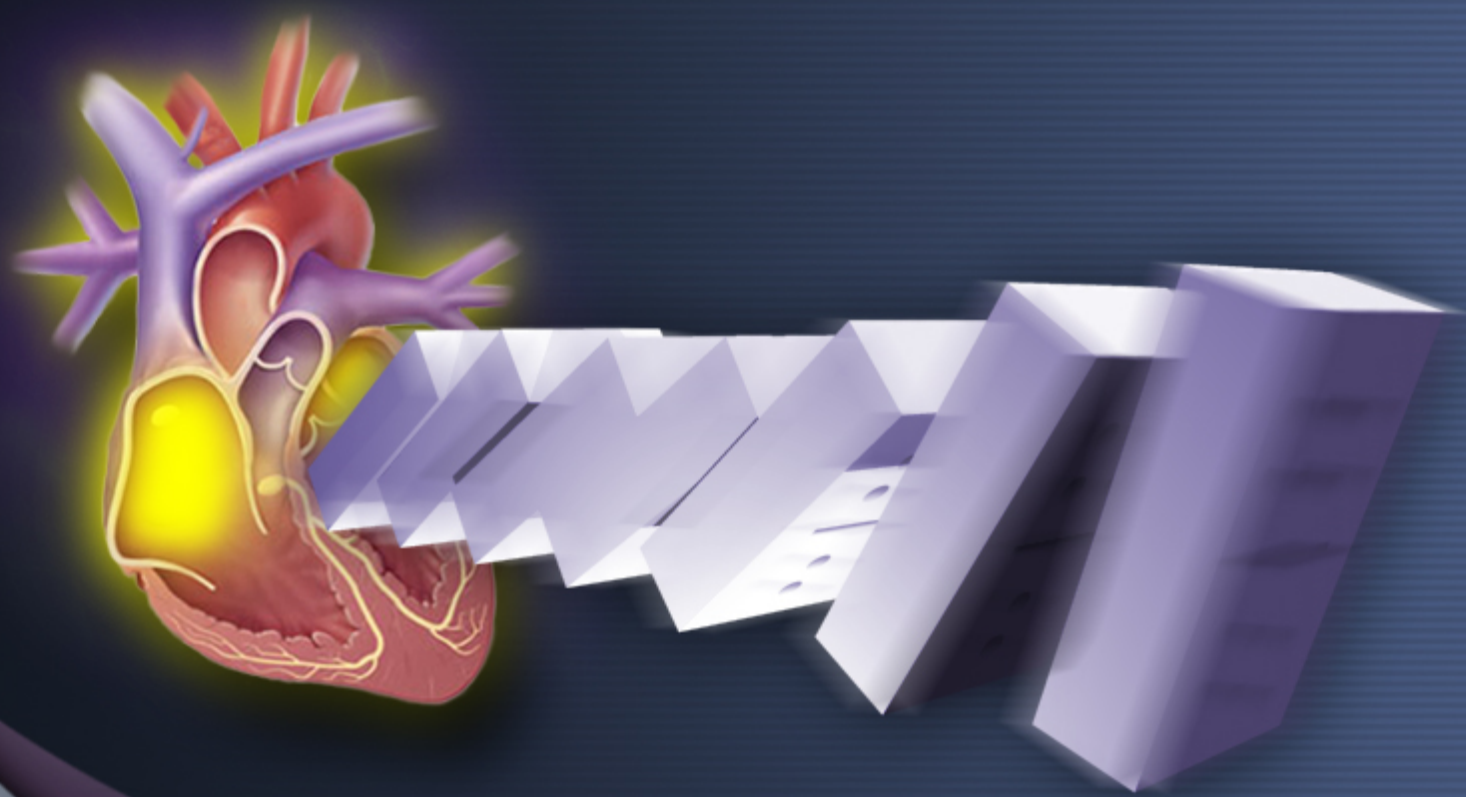
Cardiac Cells



- **Spontaneously depolarize**
- **Generally present in:**
  - Upper (SA Node)
    - 60-100 BPM
  - Middle (AV Junction)
    - 40-60 BPM
  - Lower (Purkinje Network)
    - 20-40 BPM

Automaticity

Once a pacemaker cell initiates an impulse, its neighboring cells follow suit - like dominos!



Question?

What Triggers the First Cell?

Na and Ca influx

Question?

Now that we understand impulse formation and normal heart function, let's think…

What can possibly go wrong?

Receptors

- **Adrenergic**
  - Sympathetic nerve fibers that use epinephrine or epinephrine-like substances as neurotransmitters
- **Cholinergic**
  - Parasympathetic nerve fibers that use acetylcholine as neurotransmitter


RHYTHM CLASSIFICATIONS

Classifications

- Fast
- Slow
- Normal
- “No”


RHYTHM DISORDERS
Tachyarrhythmias

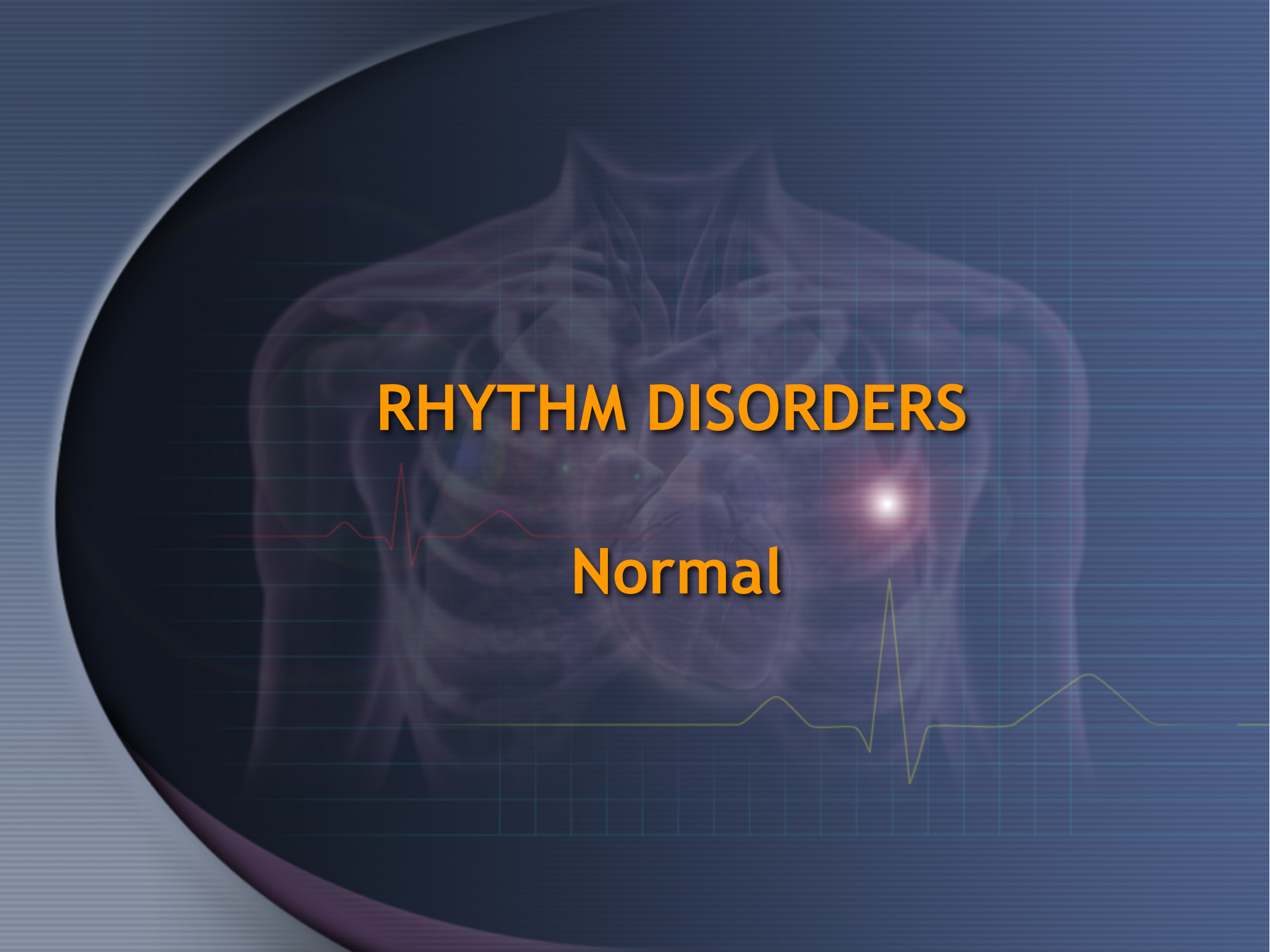
Tachyrhythms

- Sinus Tach
- V-Tach
- SVT
- Junctional Tach
- A-Fib with RVR
- MAT


RHYTHM DISORDERS
Bradyarrhythmias

Bradyrhythms

- Sinus Brady
- Junctional
- 2nd degree Type II
- 3rd degree HB


RHYTHM DISORDERS
Normal

Normal Rhythms

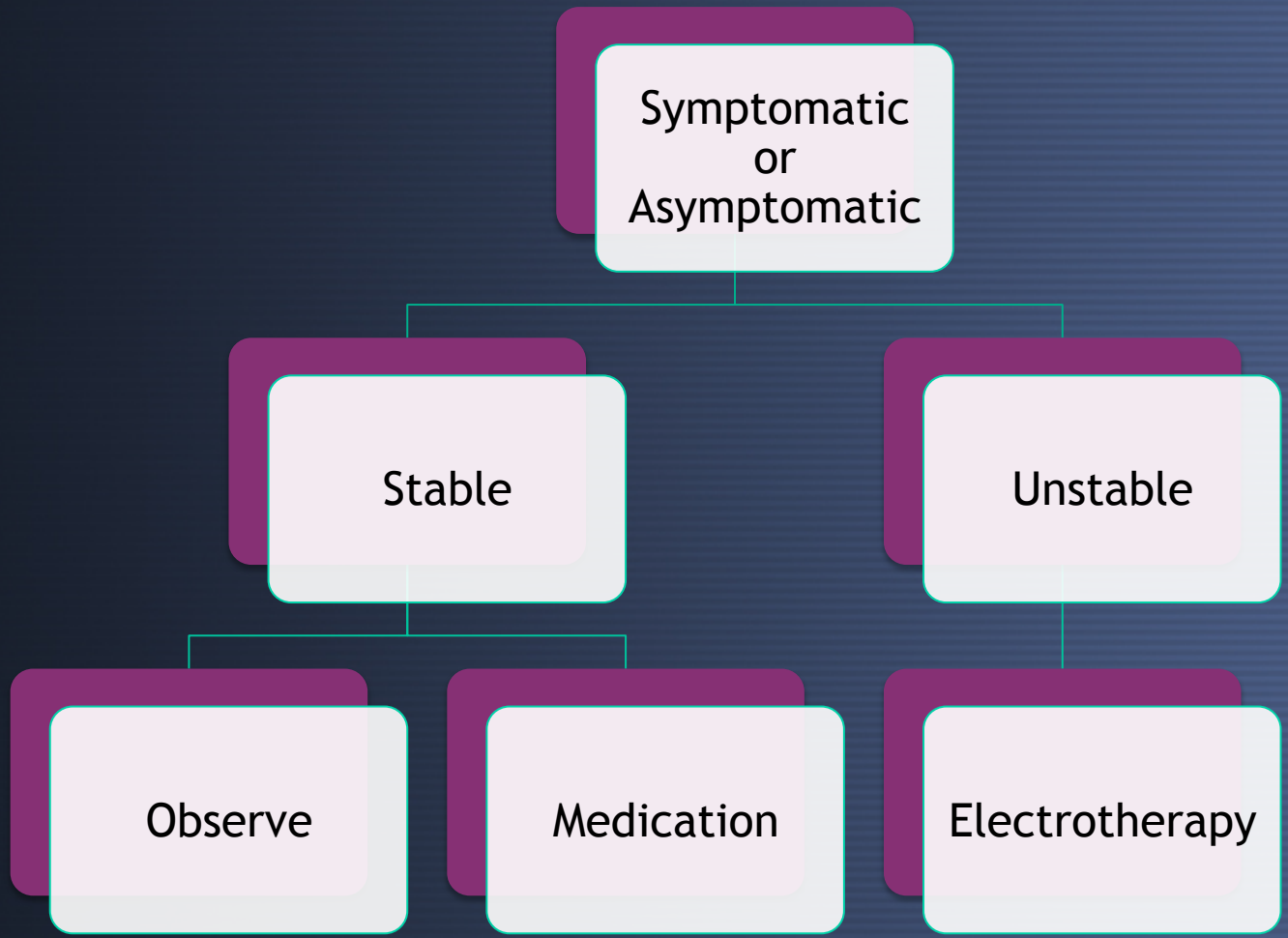
- Sinus Rhythm
- Accelerated Junctional
- A-Fib
- A-Flutter
- 1st degree HB
- 2nd degree type I HB


RHYTHM DISORDERS
“No”

NO Rhythms

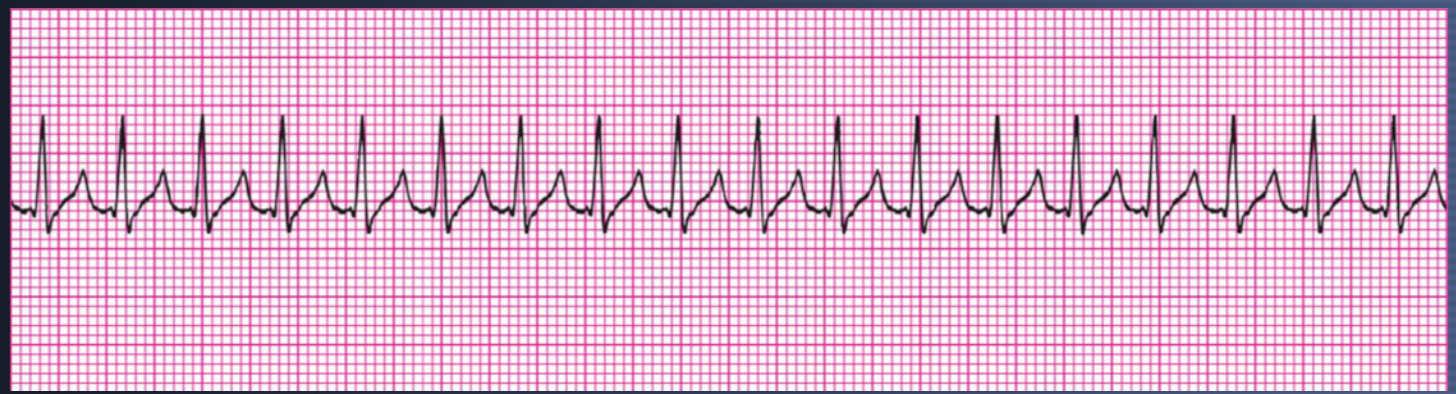
- V-Fib
- Pulseless V-Tach
- PEA
- Asystole
- IVR
- PAC
- PJC
- PVC

Treatment


Symptomatic or Asymptomatic
Stable
Unstable
Observe
Medication
Electrotherapy

Case 1

You respond to a 46 year-old female complaining of her “heart racing”. Skin is pale, cool and dry. VS: A&O x 4, RR 24, HR 170, BP 104/60. EKG reveals:

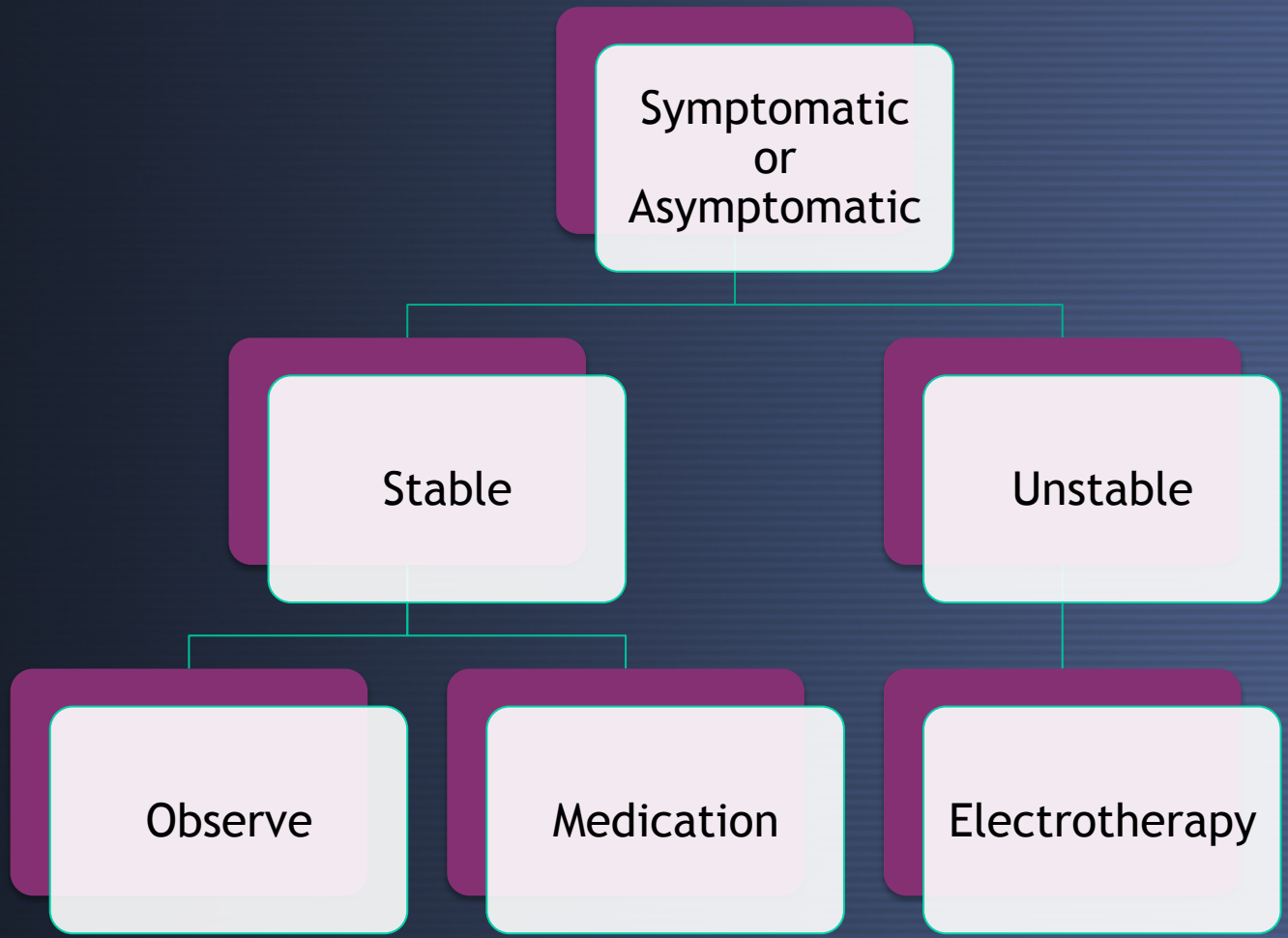


Identify the Rhythm

- Fast, Slow, Normal or No?
- Is there a P wave present?
- Regular or Irregular?
- QRS wide or narrow?

- Sinus Tach
- V-Tach
- SVT
- Junctional Tach
- A-Fib with RVR
- MAT

Treatment


Symptomatic or Asymptomatic
Stable
Unstable
Observe
Medication
Electrotherapy

SVT Treatment

- Stable
  - Vagal
  - Adenosine
- Unstable
  - Synchronized Cardioversion

Case 2

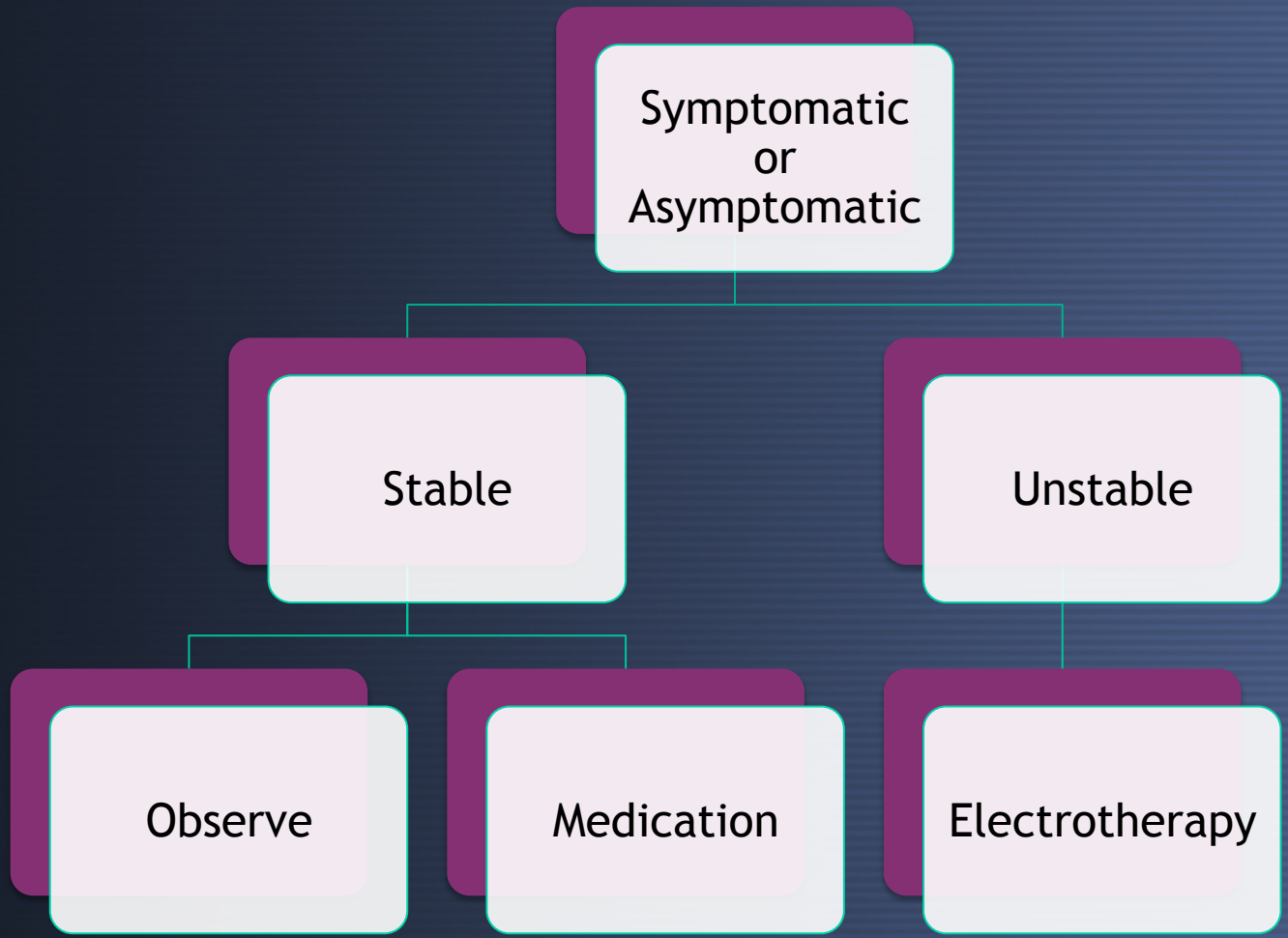
You respond to a 66 year-old male complaining of weakness. Skin is pale, cool and diaphoretic. VS: A&O x 2, RR 28, HR 38, BP 70/30. EKG reveals:

Identify the Rhythm

- Fast, Slow, Normal or No?
- Is there a P wave present?
- PR interval?
- Regular or Irregular?
- QRS wide or narrow?

- Sinus Brady
- Junctional
- 2nd degree Type II
- 3rd degree HB

Treatment


Symptomatic or Asymptomatic
Stable
Unstable
Observe
Medication
Electrotherapy

HB Treatment

- Stable
  - Atropine? Cause?
- Unstable
  - PACE or face the END
    - Pacing
      - Sedation?
      - Atropine?
    - Pressors
      - Epinephrine
      - Norepi
      - Dopamine

Case 3

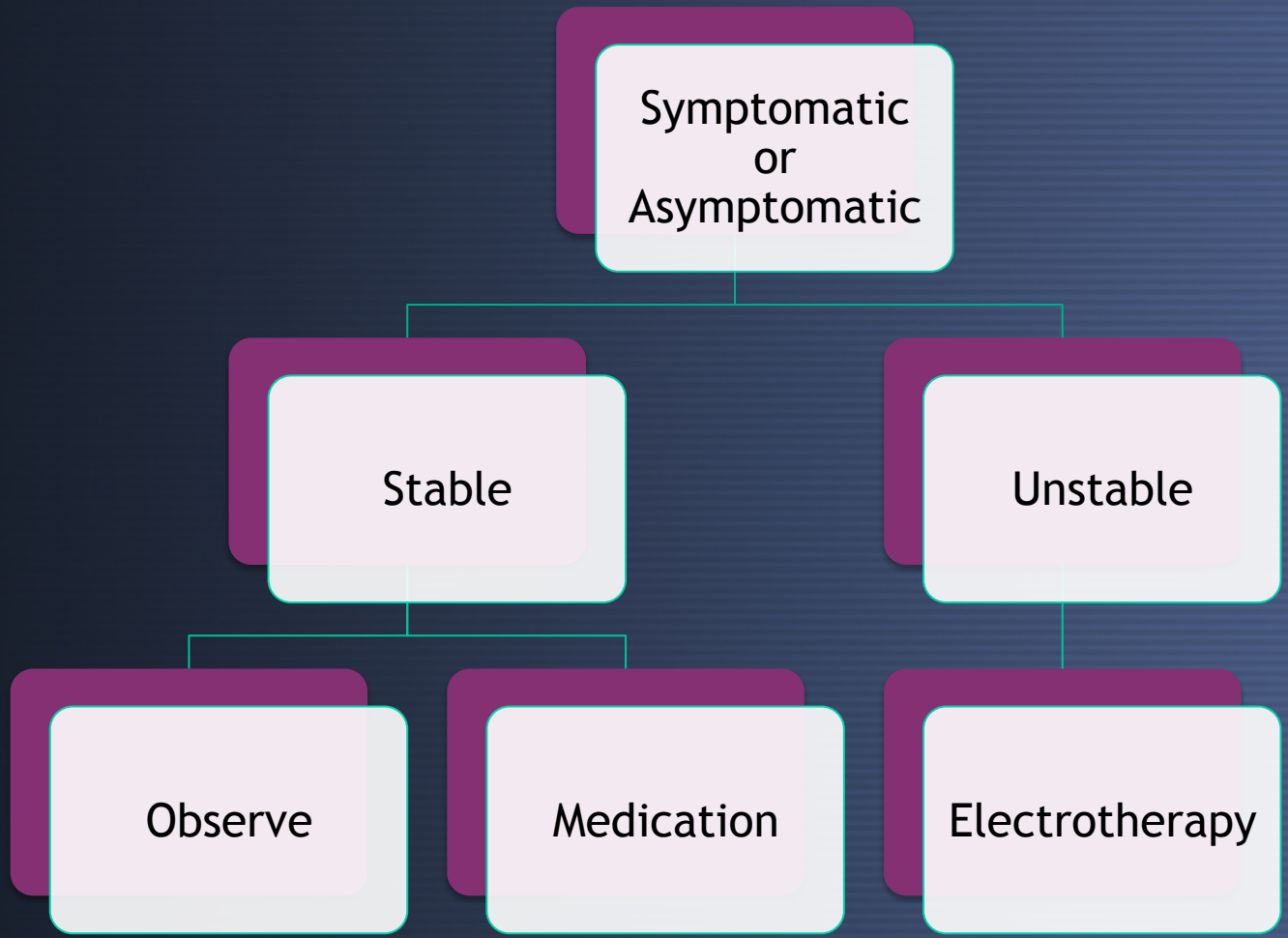
You respond to a 26 year-old female ejected from a vehicle. Skin is pale, cool and moist. VS: Unresponsive, RR 0, No Pulse, BP UTO. EKG reveals:

Identify the Rhythm

- Fast, Slow, Normal or No?
- Is there a P wave present?
- Regular or Irregular?
- QRS wide or narrow?

- V-Fib
- Pulseless V-Tach
- PEA
- Asystole
- IVR

Treatment


Symptomatic or Asymptomatic
Stable
Unstable
Observe
Medication
Electrotherapy

PEA Treatment

- Unstable
  - **P**erform good compressions
  - **E**pinephrine every 3-5 mins
  - **A**ssess the potential causes
    - H's and T's
    - PATCH-MI

Assess Causes

- Pills, P.E.
- Acidosis
- Tension Pneumo
- Cardiac Tamponade
- Hypoxia, Hypovolemia, Hypoglycemia, Hypo/Hyperkalemia, Hypothermia
- MI

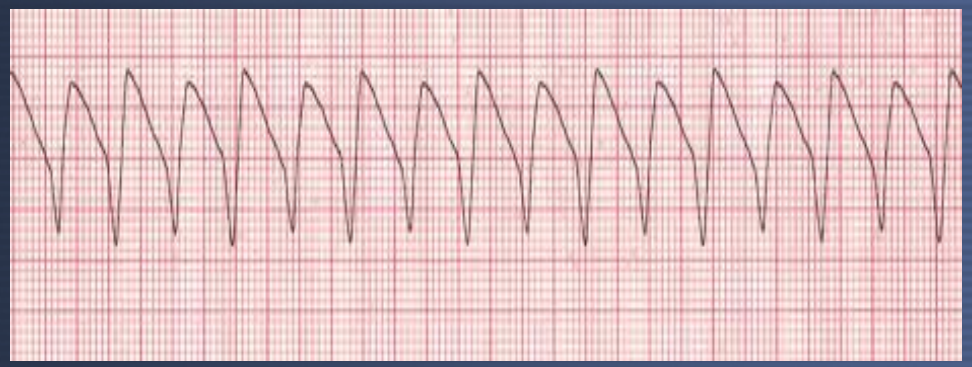
Case 4

You respond to a 70 year-old male complaining of “an elephant on my chest”. Skin is pale, cool and dry. VS: A&O x 4, RR 24, HR 180, BP 104/60. EKG reveals:

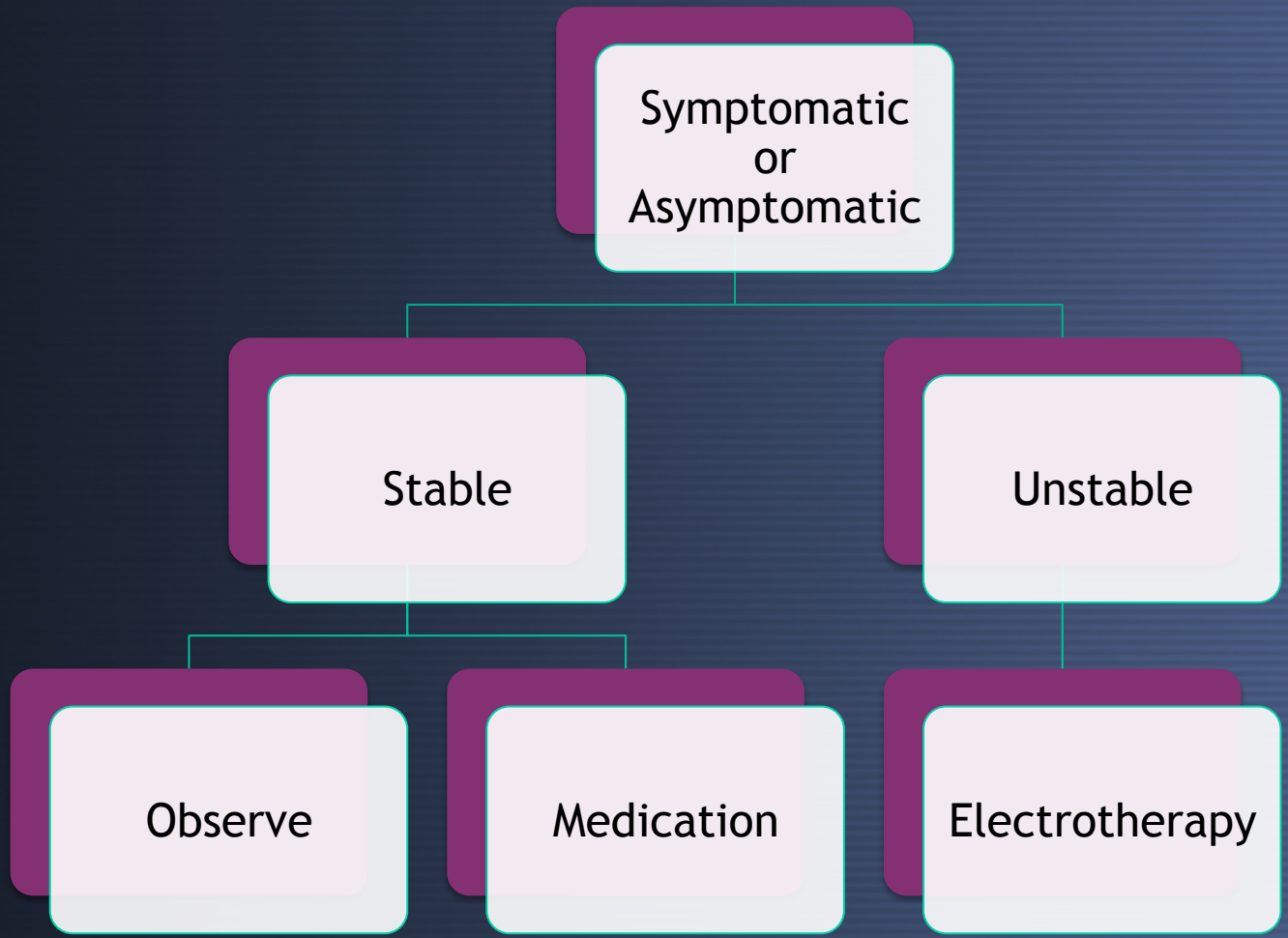
Identify the Rhythm

- Fast, Slow, Normal or No?
- Is there a P wave present?
- Regular or Irregular?
- QRS wide or narrow?

- Sinus Tach
- V-Tach
- SVT
- Junctional Tach
- A-Fib with RVR
- MAT



Treatment


Symptomatic or Asymptomatic
Stable
Unstable
Observe
Medication
Electrotherapy

SVT Treatment

- Stable
  - Adenosine?
  - Antidysrhythmic
- Unstable
  - Synchronized Cardioversion

Case 4

- As you are drawing up the Adenosine, the patient becomes altered and BP is now 80/60. What do we do?
- The patient is cardioverted and you now see this on the monitor:

Identify the Rhythm

- Fast, Slow, Normal or No?
- Is there a P wave present?
- Regular or Irregular?
- QRS wide or narrow?

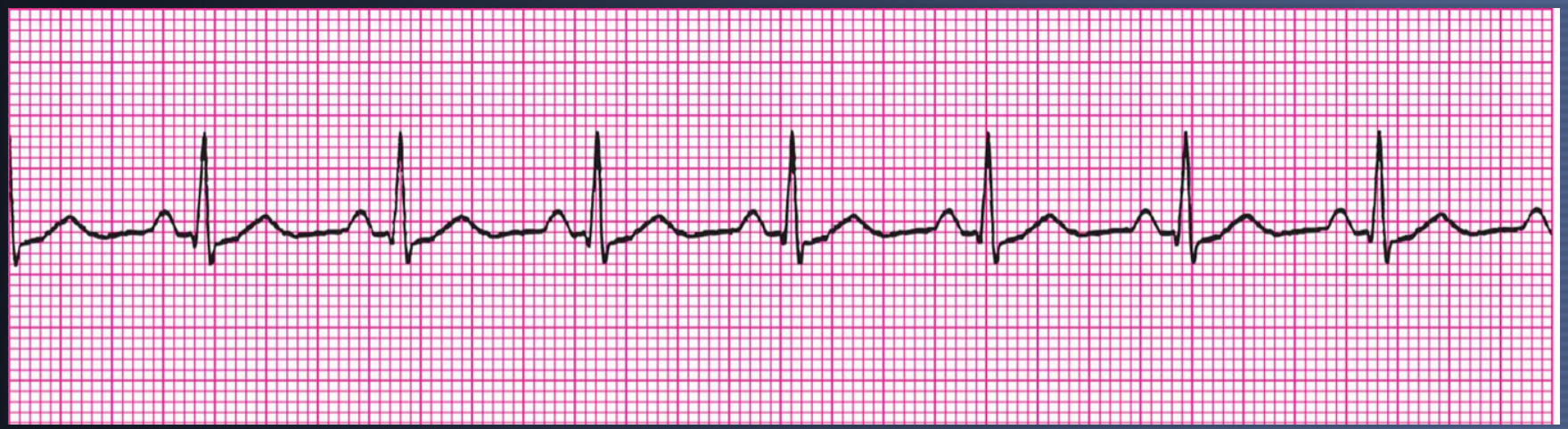
- V-Fib
- Pulseless V-Tach
- PEA
- Asystole
- IVR

Treatment

- Defib or CPR?
- Pt is defibrillated, so what's DA DEAL?
  - Deliver good compressions
  - Asess causes
  - Defib at 200 Joules every 2 mins
  - Epi 1:10,000, 1 mg every 3-5 mins
  - Amiodarone 300mg OR
  - Lidocaine 1-1.5mg/kg

Case 4

- After delivering the second shock, you see this on the monitor:



- What do you do?

Treatment

- After 2 minutes of CPR, you have a pulse!
- ROSC Protocol?
  - Manage Airway
  - If unable to follow commands, Chill Out!
    - Cold fluids
    - Maintain Map 90-100
  - Mag Sulfate 4 gms over 15 minutes

Summary

- Use the 5 step process!
- Narrow down the options!
- Follow ACLS protocol

QUESTIONS?

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